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DISCLAIMER STATEMENT

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ABSTRACT

Postoperative pain remains one of the most common and difficult problems encountered in clinical practice. Pain can affect numerous physiological processes and prolong surgical recovery. This descriptive study was conducted to determine if relationships exist between type of surgery, pain relief and occurrence of *side effects*. A retrospective chart audit of 133 surgical patients who received *co-axial narcotics* for pain management was conducted. The sample was obtained from a 155 bed hospital. A description of patients' age, gender, type of surgery, type of narcotic infusion, side effects, incidence of breakthrough pain, and treatments were recorded and cross tabulated. The following three surgical categories emerged; abdominal, thoracotomy, and orthopedic. Breakthrough pain was reported in 76(58.9%) cases, of these fifty seven (75%) had abdominal surgery, 17(22.4%) had thoracic surgery, and 2(40%) had orthopedic surgery. By surgical category breakthrough pain occurred in 57 of 106(54.8%) abdominal cases, 17 of 22(81%) of thoracotomies, and 2 of 5(40%) of orthopedic cases. Side effects included 6(4.7%) respiratory depression (n=6). The incidence of nausea and vomiting was comparable within abdominal and thoracotomy cases, 34.9% and 31.8% respectively. Pruritis occurred in 18(17.6%) of abdominal cases and 5(22.7%) of thoracotomies. Inconsistencies in documentation and noncompliance with written guidelines for patient monitoring was found. Recommendations included further education for nurses in proper and timely documentation and creation of a pain management service team.

Key words: **Postoperative**, **Pain**, **Co-axial**, **Narcotics**, **Side Effects**.

A DESCRIPTIVE STUDY OF A PERIOPERATIVE PAIN SERVICE PROGRAM

by

LISA M. BELL, BSN, USAF, NC

THESIS

Presented to the Graduate School of Nursing Faculty of the Uniformed Services University of the Health Sciences in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES

October 1999

PREFACE AND/OR FOREWORD

This research was conducted to determine if any relationships exist between the type of surgery, efficacy of pain control with co-axial narcotics, and the occurrence of side effects. It was designed to provide a foundation for those health care providers who manage postoperative pain to ensure adequate pain relief is achieved with the fewest side effects.

DEDICATION AND/OR ACKNOWLEDGMENT

I would first like to thank my thesis committee, Dr. Maura McAuliffe, Dr. Eugene Levine, and Major Nicholas Gabriel for their guidance during this tedious adventure. To my study buddies, I couldn't have done this without you. Your friendships are definitely some of the best memories I will take with me from USUHS. To my parents whose presence lives on in my heart forever. To my family for all your love and support, which has meant more than words can say, not only while in school but throughout my entire life. And last but definitely not least, to my best friend and love of my life, my husband Rich. Your unconditional love and support has given me the strength and confidence to reach for the stars and achieve all of my dreams. I LOVE YOU!

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CHAPTER I: INTRODUCTION

Background

Treatment of postoperative pain is an essential element of perioperative care. However, postoperative pain remains one of the most common and difficult problems encountered in clinical practice of health care providers (Slack & Faut-Callahan, 1990). Despite dramatic advances in pain control over the past ten years, many patients in the both hospital and the community continue to suffer unrelieved pain (Carr & Thomas, 1997). Up to three-quarters of patients experience moderate to severe pain while still in the hospital. Research has demonstrated that the intensity of postoperative pain after major surgical procedures is often underestimated and inadequately treated by health care workers (Browne, 1996). Pain is subjective in nature and there are no universally accepted means for its quantification. According to McCaffery and Beebe (1989), "pain is whatever the experiencing person says it is, existing whenever the experiencing person says it does" (p. 7).

Physicians and nurses have often been charged with undertreating pain in their patients (Browne, 1996). One reason for this is that medical and nursing schools have traditionally overemphasized the side effects of pain medications. Also, who oversees pain management effects efficacy of treatment. Diverse educational backgrounds of surgeons, anesthesia providers, and nurses directly influence care provided.

Experiences and attitudes of patients can influence their responses to measures utilized to treat pain. Patients responses to analgesics vary, resulting in standardized dosing regimens being insufficient for

some patients. Psychological variables that influence perception of pain include: personality, upbringing, culture, beliefs, and the degree of anxiety, apprehension, and fear before surgery. Physiological variables include: site and nature of operation, type of incision, and surgical manipulation (Slack & Faut-Callahan, 1990). All of these differences can impact the plan of care in prescribing pain management.

Physiology of pain

Nociceptors, or pain receptors, in the skin and other tissues of the body transmit pain impulses following tissue injury. Nociceptors are classified as A, B, and C fibers according to transmission speed and size.

Pain impulses are carried primarily on two types of fibers, the A-delta and C fibers. A-delta fibers are myelinated and carry nociceptive impulses rapidly, at speeds of up to 30 milliseconds (m/s). These small fibers primarily respond to intense mechanical stimulation, producing sharp and prickly pain sensations that subside quickly. Impulses conducted by the unmyelinated C fibers are conducted at much slower speeds and produce persistent, poorly localized, long-lasting burning sensations (McShane, 1992).

Pain fibers enter the spinal cord through the dorsal roots. The peripheral afferent neuron, termed the first-order neuron, has its cell body located in the dorsal root ganglion and sends axonal projections into the dorsal horn and other areas of the spinal cord. The pain fiber ascends and descends one or two levels, activating adjacent spinal cord segments. A synapse occurs with a second-order afferent neuron. The cell body of the second-order lies in the dorsal horn. Axonal projections of this neuron cross to the contralateral hemisphere

of the spinal cord. This second order afferent neuron ascends from that level in the lateral spinothalamic tract to synapse in the thalamus. Along the way this neuron divides and sends axonal branches that synapse in the regions of the reticular formation, nucleus raphe magnus, periaqueductal gray, and other areas in the brain stem. In the thalamus, the second-order neuron synapses with a third-order afferent neuron, sending axonal projections into the sensory cortex. At these higher centers the signal is interpreted as pain (Lubenow, Ivankovich, & McCarthy, 1997).

Opioids mechanism of action

The cerebral cortex can modify pain by stimulating release of endogenous, pain mediating, opiate-like substances called enkephalins. These substances bind to receptors in the substantia gelatinosa of the gray matter's dorsal horn and floor of the fourth ventricle (McShane, 1992).

Substance P is believed to be a neurotransmitter that facilitates pain transmission. Enkephalins are thought to act by decreasing the release of substance P, thereby inhibiting the transmission of nociceptive impulses (Olsson, Leddo, & Wild, 1989).

Narcotics administered epidurally affect pain transmission at the opioid receptors in the substantial gelatinosa of the dorsal horn, periaqueductal gray, and the floor of the fourth ventricle (Olsson, Leddo, & Wild, 1989). The narcotics bind to opiate receptors and facilitate the release of enkephalins. The release of substance P is decreased, thus decreasing pain impulses (Pendergrass, 1991).

Implications of pain

Pain has been demonstrated to affect numerous physiological

processes that can prolong the recovery process. This necessitates the need for more efficacious means to control pain. The clinical relevant sequelae for pain in surgical patients include; nausea, vomiting, and ileus; loss of muscle tissue, contributing to postoperative fatigue; increased demands on the heart and lungs, and changes in blood flow, coagulation, and fibrinolysis (Kehlet, 1996).

Pain alters pulmonary function and, subsequently, increases pulmonary complications. Pain causes a pattern of rapid, shallow breathing with a reduced number or absence of deep breaths. This predisposes the patient to retention of pulmonary secretions and pulmonary collapse. Major pulmonary complications such as atelectasis, infection, and arterial hypoxemia may then develop. These complications, especially hypoxemia, has occurred days after major upper abdominal or thoracic surgery.

Pain potentiates the stress response following surgery. The stress response is characterized by increased sympathetic tone, hypothalamic stimulation, increased catecholamine and catabolic hormone secretion, and decreased secretion of anabolic hormones. Antidiuretic hormone and aldosterone secretion are increased, leading to metabolic disturbances. There is a growing recognition that analgesia is an important factor in preventing this stress response to surgery, thereby improving patient outcomes. This stems from the hypothesis that pain is one component of the neural, endocrine, metabolic, and inflammatory interactions that make up the stress response (Lewis, Whipple, Michael, & Quebbeman, 1994).

Pain also hinders mobility. Inactivity postoperatively can lead to thromboembolic conditions resulting in further pulmonary and

cardiovascular sequelae, prolonging recovery and increasing the length of hospital stay.

Co-axial narcotics

Co-axial narcotics is one of the most recent advances in the management of pain. The term "co-axial" narcotic means injection of opioids into the epidural space and/or subarachnoid space for pain management. The initial application of opioids intra- thecally in human beings for the treatment of intractable cancer pain, led to the widespread postoperative use of spinal opiates in the 1980s (Bragg, 1989).

Managing pain with co-axial analgesia is useful because it requires a lower dose of narcotic and provides a higher quality of pain relief than other analgesic routes (Slack & Faut-Callahan, 1990). Co-axial narcotics provide intense analgesia with less central (CNS) depressant effects, as seen with systemic narcotics. Co-axial analgesia does not produce the sensory, motor, or autonomic interference associated with local anesthetics. A study by Mahoney, Noble, Davidson, and Tullos (1992) demonstrated that patients receiving continuous epidural analgesia had greater pain relief, improved rehabilitation courses, shorter hospitalizations, less need for oral narcotics, and were generally more satisfied.

Limitations of co-axial narcotics. Although use of co-axial narcotics has proven to be beneficial, its practice outside the intensive care unit (ICU) remains controversial. Many factors have influenced and restricted its use. According to Salomaki, Kokki, Turunen, Havukainen and Nuutinen (1996), side effects and organizational problems have limited the use of postoperative epidural

analgesia outside the ICU. These factors have limited use of co-axial narcotics in the late postoperative period when the patients discharged from the ICU and have increased mobility. Also, many surgeries do not require ICU care postoperatively and "to require admission to the ICU for the administration of epidural morphine is to deprive some patients of the benefits of the technique" (Ready, Loper, Nessly, & Wild, 1991, p. 455).

Potential adverse effects of co-axial analgesia tends to be the number one reason given for restricting areas where this pain management may be utilized. The most common adverse effects include respiratory depression, urticaria, nausea and vomiting, and urinary retention.

Respiratory depression is the side effect of co-axial narcotic administration that causes the greatest concern. Concern for the occurrence of potentially catastrophic respiratory depression is the primary reason that some institutions limit the usage of epidural narcotics to ICU or post anesthesia care units (PACU) (Lubenow & Ivankovich, 1991).

Respiratory depression can be classified as early or late. Early respiratory depression occurs as a result of uptake via the vasculature in the spinal cord area. Plasma concentrations of morphine after epidural injection rise sharply within 15 minutes of administration, leading to respiratory depression within one hour (Olsson, Leddo, & Wild, 1989).

Late respiratory depression occurs due to a cephalad diffusion (Hambleton, 1994). Delayed onset is related to lipid solubility of some narcotics. Morphine is a commonly used narcotic associated with

this complication. It is water-soluble and prone to retention in the cerebrospinal fluid (CSF) and systemic circulation (Naber, Jones, & Halm, 1994). Morphine slowly spreads cephalad in the spinal canal to the respiratory centers located in the medulla oblongata, resulting in respiratory depression (McShane, 1992). The onset and severity of respiratory depression is not predictable, but has been reported to occur as late as 24 hours, with peak incidence between six and 12 hours (Olsson, Leddo, & Wild, 1989).

Side effects related to opioids are not limited to co-axial routes. Regardless of their route of administration, opioids are associated with pruritis, nausea, vomiting, urinary retention, and respiratory depression (Hopf & Weitz, 1994). Although, previous studies (Ready et al., 1991; Rygnestad, Borchgrevink, & Eide, 1997; Salomaki et al., 1996) have demonstrated that epidural narcotics can be safely administered on general medical/surgical wards, many facilities continue to require patients be admitted to the ICU for monitoring. This will be discussed further in chapter two. These institutional policies have limited the use of co-axial narcotics.

Nurse's role in pain management

A key factor in pain management is the pivotal role nurses play. According to McCaffery and Beebe (1989), the nurse's unique role in the care of patients with pain can be distinguished from other members of the health team in part by the amount of time spent in direct patient care. Nurses spend more time with patients who have pain than any other health care provider. The care of patients with pain is ideally managed by a multidisciplinary approach however, in most cases, nursing is the cornerstone. The nurse's role in the care of people with pain

includes: carrying out pain relief methods with and for the patient, identifying the need for change or additional methods in pain management, initiating these changes, and assessing the impact of the care on the patient. When nurse's are knowledgable in managing pain, patients receive the best results.

As co-axial narcotic infusion has become a common technique in the management of pain, nursing involvement in patient care has expanded. Nurses must be knowledgeable about associated risks and benefits of the method and medications utilized. This would include common side effects, signs of toxicity, and maintenance of equipment. The success or failure of epidural pain control outside the operating room and ICU, depends, in part, on nursing vigilance and care (McShane, 1992). Safe and effective nursing supervision should decrease associated complications and promote faster recovery times.

Problem

Pain is a major determinant in how quickly patients recover from surgical interventions. Co-axial narcotics have been shown to be beneficial, however, these methods have been limited due to the potential for adverse effects and institutional policies. There is a need to determine in which surgical cases co-axial narcotics provide the best pain relief, with the fewest side effects. Based on this information, anesthesia providers, who typically are the health care providers who initiate co-axial narcotics can identify those surgical cases in which co-axial narcotics provide the maximum patient benefit with fewest side effects.

Purpose of the Study

The purpose of this study is to examine one institutions co-axial

pain management service, using a retrospective chart audit. A description of patient's age, gender, type of surgery, co-axial route (intrathecal or epidural), side effects, and treatments will be generated. This data will provide a description of those surgical cases that benefit the most from co-axial narcotics, with the fewest side effects.

Research Question

What types of surgical cases do patients using co-axial narcotics experience the greatest amount of pain relief, with fewest side effects?

Conceptual Framework

The framework upon which this study is based is Virginia Henderson's conceptual framework for nursing. Henderson incorporated physiological and psychological principles into her personal concept of nursing (DeMeester, Lauer, Marriner-Tomey, Neal, & Williams, 1994). Her definition of nursing is as follows:

> The unique function of the nurse is to assist the individual, sick or well, in the performance of those activities contributing to health or its recovery (or to a peaceful death) that he would perform unaided if he had the necessary strength, will, or knowledge. And to do this in such a way as to help him gain independence as rapidly as possible (Furukawa & Howe, 1995).

Henderson identifies 14 basic needs of the patient, which comprise the components of nursing care. She views health in terms of the patient's ability to perform these components of nursing care unaided. These components include: (a) breathe normally, (b) eat and drink adequately, (c) eliminate body waste, (d) move and maintain a desirable

position, (e) sleep and rest, (f) select suitable clothes- dress and undress, (g) maintain body temperature within normal range by adjusting clothing and modifying the environment, (h) keep the body clean and well groomed and protect the integument, (i) avoid dangers in the environment and avoid injurying others, (j) communicate with others in expressing emotions, needs, fears, or opinions, (k) worship according to one's faith, (l) work in such a way that there is a sense of accomplishment, (m) play or participate in various forms of recreation, (n) learn, discover, or satisfy the curiosity that leads to normal development and health and use the available health facilities.

Henderson equates health with independence. The 14 care components help move the patient from a state of dependence (illness) to a state of independence (health). In this conceptualization, persons choose their state of health. The nurse can facilitate these choices; however, the ultimate responsibility for health lies with the individual (Runk & Muth-Quillin, 1989).

Henderson describes nursing activity as deliberate; each nursing action is planned, executed, and evaluated. The 14 components of nursing care are prioritized, acted upon, and assessed for effectiveness. The patient is expected to actively participate in care, identifying his/her own needs and comply with interventions (Runk & Muth-Quillin, 1989).

A person is identified as a biological being whose mind and body are inseparable. Henderson emphasizes how the factors of age, cultural background, physical and intellectual capacities, and emotional balance affect individual health (Furukawa & Howe, 1995). The person, as conceptualized by Henderson, has fundamental needs for shelter, food,

and communication (Runk & Muth-Quillin, 1989).

Henderson identifies three levels comprising the nurse-patient relationship: a) the nurse as a substitute for the patient, b) the nurse as a helper to the patient, and c) the nurse as a partner with the patient. Application of these relationships can be demonstrated during the perioperative period. Intraoperatively, the nurse/anesthetist is the "substitute for what the patient lacks to make him 'complete,' 'whole,' or 'independent,' by the lack of physical strength, will, or knowledge" (DeMeester et al, 1994, p.106). During convalescence the nurse/anesthetist helps the patient acquire or regain his independence. Effective pain control postoperatively, along with other needs being met, can enhance and accelerate achievement of this independence. As partners, the nurse and patient together formulate a plan of care. As the patient becomes more independent, the role of the nurse diminishes.

In summary, nursing primarily complements the patient by supplying what he needs in knowledge, will, or strength to perform his daily activities (Henderson, 1966). Henderson compares the entire medical team, including patient and family, to a wedge on a pie graph (see Figure 1). The size of each member's section depends on the patient's current needs, changing as the patient progresses toward independence (DeMeester et al, 1994).

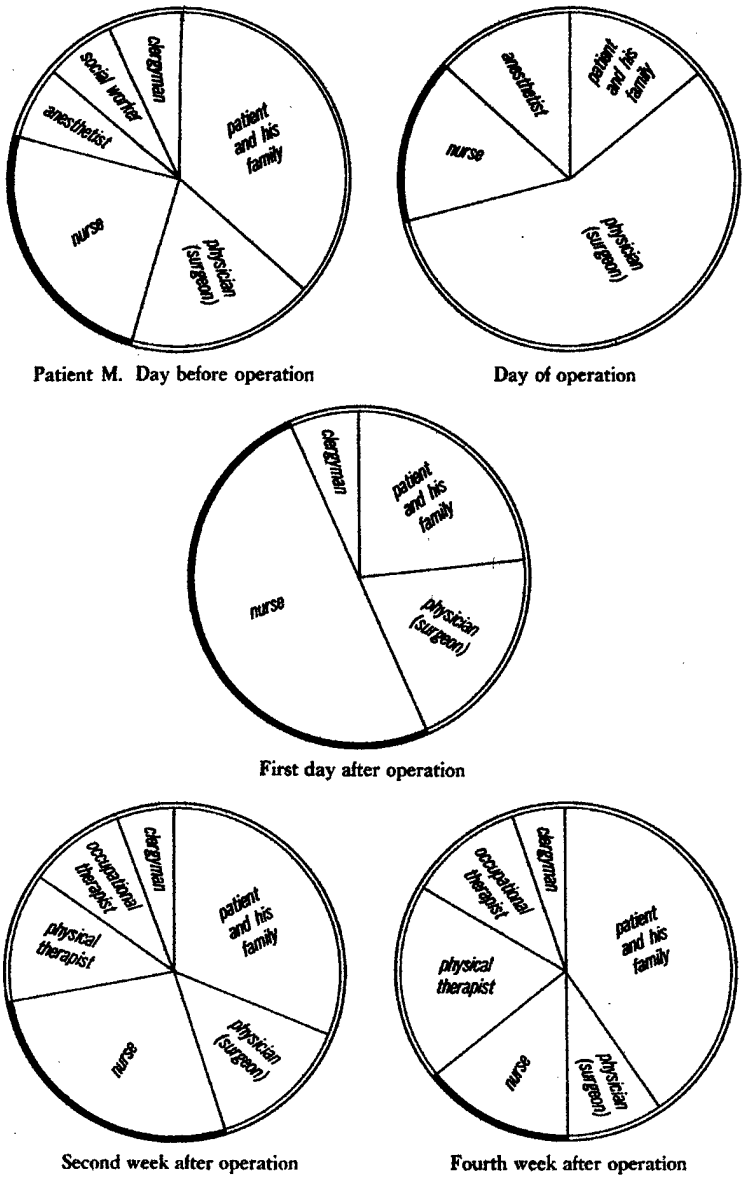

Figure 1. How Providers, Patient, and Family Roles Change as Periopertive Period Progresses.

Definitions: Conceptual and Operational

Surgical cases

Operational-operations that occurred and received epidural analgesia for pain management.

Co-axial narcotics

Operational-only epidural Morphine/Fentanyl.

Pain relief

Conceptual Definition; is an unpleasant sensory and emotional experience arising from actual or potential tissue damage or described in terms of such damage.

Operational Definition; pain score greater than 4 out of 10 on the 0-10 pain scale: 0=no pain and 10-worst possible pain. Pain score greater than 2 out of 5 on the Wong-Baker faces pain rating scale. Pain score greater that 1 out of 5 on the Behavioral pain rating scale. (Appendix A).

Side Effects

Conceptual Definition; unwanted outcomes.

Operational Definition; nausea and vomiting, urticaria, and urinary retention present or absent. (Appendix A).
Respiratory depression-respiratory rate less than or equal to 10/minute, apnea greater than 20 seconds, oxygen saturation less than 90%, or PaCO2 greater than 50mmHg. (Appendix B).

Assumptions

1. Documentation of pain relief and side effects is annotated appropriately.
2. Pain is undesirable. People choose their state of health. Nursing scope of practice enables nurses to assist patients to achieve health.

Limitations

This is a retrospective study which limits the generalizability of findings.

Summary

Postoperative pain continues to be a significant problem in clinical practice. Pain has been demonstrated to affect numerous physiological processes prolonging recovery. This necessitates a need to improve pain management techniques. Identifying which co-axial narcotics enhance pain relief for specific surgical cases will assist health care providers to prescribe effective pain relief measures. This will facilitate a patient's recovery and his or her ability to reach independence (health).

CHAPTER II: LITERATURE REVIEW

Introduction

This review is based upon the available literature related to co-axial narcotics utilized for postoperative pain. It includes the history of pain and pain management, present techniques, frequency of adverse effects, and efficacy of co-axial narcotics.

Historical Review of Pain and Pain Management

Pain is as old as mankind. In ancient civilizations pain resulting from an injury could easily be understood. Pain resulting from disease, however, bordered on the mystical side. Early man considered such pain to be the result of an intrusion into the body by magical fluids, demons, or objects (Jaros, 1991). With the thought of evil forces afflicting early man, the role of shaman (medicine man), and sorcerer arose. Treatment consisted of extracting the intruding object, or making efforts to ward off or frighten away the pain demons with such ornaments as talismans, amulets, and tiger claws. In some primitive societies, tattoos with exorcist signs, were applied to the skin to keep evil spirits outside the body (Bonica, 1991).

Egyptians believed that pain from sources other than wounds were caused by religious influences of their gods or spirits of the dead (Bonica, 1991). They believed that through vomiting, sneezing, urinating, or sweating, demons or spirits were able to escape from the body (Warfield, 1988).

Later beliefs emerged that the cause of pain evolved from evil spirits due to the commitment of sin and the consequent punishment inflicted by an offended deity (Bonica, 1991). As a result, the medicine man was replaced by the priest. In addition to prayer, the priest utilized natural remedies, consisting mostly of herbs to treat pain.

One of the earliest references to the use of pain relieving drugs is found in the writings of Homer, a Greek poet in approximately 800 B.C. Further documentation is found in the Ebers papyrus, which was written about 1550 B.C. and includes an early Egyptian pharmacopeia which contains many prescriptions for the use of opium (Bonica, 1991).

The Renaissance (15th Century) period demonstrated a renewed interest in the humanities. This new spirit of independent learning emerged with a consequent fall in the subservient philosophy of theology and the authority of the church (Jaros, 1991). Attention was turned away from heaven, God, and life afterward to life on earth and the study of man, nature, and scientific methodology.

Plato's (427-347 B.C.) and Aristotle's (384-322 B.C.) works were rediscovered and studied during this period. Leonardo da Vinci, an educated scientist and artist, seemed to be influenced by Plato as he considered the brain the center of sensation rather than the heart, which Aristotle believed to be the center of sensation. Leonardo performed anatomic dissections which led him to believe that the purpose of the spinal cord was to convey sensations to the brain. He felt the sense of touch was directly related to the sense of pain (Jaros, 1991).

Reason and analytic deduction blossomed during the Renaissance. Leading the forefront was Renee Descartes, a French mathematician. He described nerves as hollow tubes through which fine threads originating in the brain coursed through the body, ending in the skin or other tissues. These fine threads transmitted sensory stimuli to the brain. Sensations had to interact with the mind or soul, which Descartes considered to be separate from the body and unaffected by external and mechanical forces. Integration of the mind and body, according to Descartes, occurred within the pineal gland. Pain, therefore, was a

state of excessive sensory awareness modulated by the mind (Jaros, 1991).

During the nineteenth century, significant advances were made in pain therapy (Bonica, 1991). Among the most important was the isolation of morphine from crude opium by Serturner in 1806. The isolation of other opium alkaloids, such as codiene, followed in 1832. In 1828, Leroux reported the isolation of salin, which led to the introduction of salicylic acid, sodium salicylate, and acetanalid. In 1899, Dresser produced acetyl salicylic acid, which was marketed by the Bayer Company as aspirin.

A milestone in the prevention and treatment of pain was the public demonstration in 1846 at the Bullfinch amphitheater of the Massachusetts General Hospital. William T. Morton provided an anesthetic to Edward G. Abbott for excision of a neck lesion. The anesthetic utilized was diethyl ether. Abbott recalled after the surgery that he was aware of the surgery, but experienced no pain (Calverley, 1997). This successful demonstration led to the development of general anesthetics.

In 1884, Karl Koller a medical student, discovered cocaine as a local anesthetic (Calverley, 1997). The discovery of cocaine and the development of the needle and syringe during the same era, led to the subsequent widespread use of local anesthesia and analgesia. Analgesia was achieved not only for surgery but also for diagnosis and therapy of nonsurgical pain (Bonica, 1991). Other methods for achieving pain management during this century included hypnosis and psychotherapeutic procedures.

During the first seven decades of this century, analgesia methods to treat acute and chronic pain advanced significantly. Progress occurred due to the development, testing, and clinical application of

systemic analgesics through advances in synthetic chemistry and pharmacology. Consequently a variety of narcotic and nonnarcotic analgesics were developed and introduced for clinical use.

Co-axial narcotics

The usage of co-axial narcotics was first introduced in the nineteenth century. J.L. Corning has been credited with being the first to use epidural analgesia in 1885. However, from his own description of the two experiments attempted, he neither intended nor achieved a genuine epidural (Bromage, 1954). August Bier performed the first spinal blockade for surgery in 1898 (Calverley, 1997). In 1901, A. Sicard and M.F. Cathelin of France popularized the caudal approach. T. Tuffier attempted epidural analgesia by the lumbar route later that same year. He was, however, unsuccessful, which discouraged further attempts of epidural analgesia for many years (Bromage, 1954). In that same year, Dr. Katawata of Japan reported the injection of 10 milligram (mg) of morphine combined with 20 mg eucaine, a local anesthetic, into the subarachnoid space of two patients with uncontrollable back pain. The patients reported excellent pain relief lasting from two days to several days. Dr. Katawata reported no side effects. For unclear reasons, this technique was abandoned for approximately 75 years (Benedetti, 1987).

In 1921, Fidel Pages renewed interest in the midline lumbar approach, demonstrating the increased ease of access and wider applicability of this route as compared with the caudal route (Bromage, 1978). His method for identifying the epidural space was primarily tactile, detecting the 'feel' of the needle passing through the ligamentum flavum into the epidural space. The degree of skill required for this technique was a limiting factor in its use. Pages provided a demonstration of epidural anesthesia in 1921, but died soon

after his paper appeared in a Spanish military journal. Ten years later, A.M. Dogliotti developed a technique that identified the epidural space by the loss-of-resistance. This technique is widely utilized today (Calverley, 1997).

During the 1930s, the mode of action of epidural blockade remained conjectural. This uncertainty of action and lack of attention to the different variables encountered between different drugs and different patients fueled the controversy related to the technical management of epidurals. The majority of anesthesia providers regarded the method as unreliable and dangerous, particularly in unskilled hands. In 1946, with the advent of neuromuscular blocking agents, use of local injection techniques suffered a sharp decline (Bromage, 1978).

In 1944, E. Tuohy of the Mayo Clinic introduced two modifications of continuous spinal techniques: the Tuohy needle and the indwelling epidural catheter. In 1949, M. Curberlo of Cuba, used the Tuohy needle and indwelling catheter to perform the first continuous epidural anesthetic. In that same year, J.G. Cleland described the use of continuous catheter epidural for postoperative analgesia. Although effective analgesia was maintained for one to five days post surgery, a significant sympathetic block accompanied the analgesia requiring all patients to receive one dose of a vasopressor (Calverley, 1997).

Ancient civilizations were the first to describe the use of narcotics. However, it wasn't until the mid 1970s that an understanding of their mode of action was discovered. In 1975, endogenous opiate-like compounds called endorphins and enkephalins were discovered. In the following year, opioid receptors were discovered in the substantia gelatinosa of the spinal cord (Bragg, 1989). Endorphins and enkephalins were thought to modulate the transmission of pain by their action on the spinal cord opiate receptors. It was proposed,

narcotics administered into either the epidural or intrathecal space might mimic this action (Yakish & Rudy, 1976). The initial application of opioids intrathecally in human beings for the treatment of intractable cancer pain, led to the widespread postoperative use of spinal opiates in the 1980s (Bragg, 1989).

Utilization of Co-axial Narcotics

Anatomy. The spinal cord is enclosed by three membranes: the pia mater, the arachnoid membrane, and the dura mater. The pia mater, the inner layer, adheres to the spinal cord. The arachnoid layer is located between the pia mater and the dura mater. The cerebrospinal fluid (CSF) flows between the arachnoid layer and the pia mater in the intrathecal (subarachnoid) space. The dura mater is the outermost layer (Olson, Ustanko, Melland, & Langemo, 1992).

The epidural space lies outside of the dura mater. This potential space contains connective and fatty tissue, arterial and venous networks, and spinal nerves (Pendergrass, 1991). "It functions as a fatty pad that surround the spinal cord and acts as a depot for narcotics" (Naber, Jones, & Halm, 1994, p.69). Intrathecal analgesia differs from epidural analgesia in that narcotics are delivered directly into the subarachnoid space (Pendergrass, 1991).

The site for introducing narcotics for epidural and intrathecal pain management is typically performed in the lower lumbar region. The layers traversed for both techniques include the skin, subcutaneous tissue, supraspinous ligament, interspinous ligament, and ligamentum flavum. The epidural method concludes by locating the epidural space. This space is generally located using the loss of resistance technique after passing through the ligamentum flavum. The intrathecal technique involves penetrating the epidural space and dura mater into the subarachnoid space, identified by the presence of CSF (Bragg, 1989).

Narcotics utilized. The most common narcotics utilized for pain management with co-axial routes are morphine and fentanyl. Based on pharmokinetics, they vary in rate of onset, duration of effect, and concentration in CSF. Morphine, which has a low lipid solubility remains within the CSF in substantial quantity and diffuses slowly into nerve tissue, accounting for its delayed onset. Its tenacious binding to opiate receptors is responsible for its long duration of action (Cohen, 1989). It has the advantage of spreading rostrally, saturating areas of the spinal cord well beyond the site of injection. Fentanyl, which is much more lipid soluble than morphine, remains in the CSF for a shorter period of time. Consequently, onset is more rapid with a shorter duration. Fentanyl is less likely to migrate rostrally, providing more of a segmental analgesic effect (Stoelting & Miller, 1994).

Intrathecal and epidural pain management both provide adequate pain relief. However, intrathecal opioids are not as widely utilized as epidural narcotics. Intrathecal narcotics are usually administered by a single injection into the subarachnoid space (Stoelting & Miller, 1994). Catheters for continuous intrathecal injections are available, however, problems with kinking of the catheter and increased risk of meningitis limit the practicality of this method. Epidural narcotics are administered intermittently or continuously into the epidural space. If proper sterile technique is maintained, an epidural catheter can be utilized to administer narcotics up to seven days (Dean, 1991).

According to Stoelting and Miller (1994), the intrathecal technique provides the advantage of precise and reliable placement of low concentrations of a drug near its site of action. Intrathecal administration of opioids immediately produces high CSF concentrations of drug (Chaney, 1995). The onset of analgesic effect is directly

proportional to lipid solubility, whereas duration is prolonged with hydrophilic drugs (Stoelting & Miller, 1994).

When a narcotic is placed in the epidural space, it must diffuse across the dura before it can reach the spinal cord and initiate its action. The diffusion of the drug is both concentration and time dependent, requiring the administration of a significantly larger amount than an intrathecal dose, and requiring a longer time for onset of action. The highly vascularized epidural space accounts for the significant redistribution of drugs, increasing the plasma drug level. (Slack & Faut-Callahan, 1991). The epidural space also contains fat, connective tissue, lymphatics, and spinal nerves, providing a depot for narcotics (Naber, Jones, & Halm, 1994).

The action of narcotics in the spinal cord resembles the action of enkephalins. Opiate receptors are present in the dorsal horn of the gray matter. This is the zone where the primary afferent synapses with the second order neuron, which in turn transmits the pain impulses to the cortex of the brain. A neurotransmitter, substance P, is believed to be released between the first and second order neuron, facilitating this transmission. Normally, enkephalinergic neurons release enkephalins, which diffuse to and bind to the opiate receptor, inhibiting release of substance P. However, this internal mechanism is limited. Narcotics are able to mimic this action of endogenous enkephalins. Narcotics diffuse into the dorsal horn and bind to the opiate receptors, blocking the release of substance P and pain transmission (Cohen, 1989).

Effects of Co-axial Narcotics

The use of co-axial narcotics for postoperative pain management is increasing in popularity. The use of narcotics in this way provide pain relief while maintaining mobility and awareness with minimal side

effects (Litwack & Lubenow, 1989). To provide efficacious and safe pain management, one needs to be aware of adverse effects that can result with co-axial narcotics. Although other side effects may occur, the four classic side effects are respiratory depression, pruritis, nausea and vomiting, and urinary retention (Bromage, Camporesi, Durant, & Nielsen, 1982; Chaney, 1995; McShane, 1992).

Stenseth, Sellevold, & Breivik, (1985) performed a prospective study analyzing the effects and side effects of epidural morphine for pain relief in 1085 patients. Patients were grouped according to the type of surgery performed. The category of surgeries included: thoracic, abdominal, urologic, and/or orthopedic. Nurses monitored patients for respiratory depression, itching, nausea and vomiting, and urinary retention. Naloxone and other treatments were recorded. Prior to discharge, the patients were interviewed for overall effectiveness of the treatment of pain and side effects. Nurses' evaluations of the effect on pain and side effects was also recorded. Satisfaction was achieved if patients were completely pain free most of the time, with minimal discomfort while coughing and deep breathing, moving around in bed, or during nursing care. The results were analyzed for statistical significance by a two tailed test with a $P<.05$ considered statistically significant.

Side effects were first evaluated based on the total dose of epidural morphine given. Dosing was divided into 4-6mg, 7-10mg, 11-15mg, and two patients who received 18mg. The study demonstrated no relationship between the total dose of morphine and the frequency of side effects (Stenseth et al., 1985).

In the total patient population, respiratory depression occurred in .9%, pruritus in 11%, nausea or vomiting in 34%, and urinary retention in 42% of the patients without foley catheters. The type of

surgery did not impact the occurrence of adverse effects, except, nausea and vomiting occurred more frequently following hip arthroplasty. This may have been related to the high number of females in this group (Stenseth et al., 1985). Females have a 2-3 times greater risk of postoperative nausea and vomiting after surgery (Moniz, 1997). Females demonstrated a significantly higher frequency of nausea than male patients in all surgeries except cholecystectomy. Nausea and vomiting occurring in male patients who were pain free (13%) versus male patients in pain (47%) was statistically significant. Among females the difference was not significant (Stenseth et al., 1985).

Respiratory depression was observed in only 10 of the 1085 patients. Nine of the patients received relatively high doses of fentanyl during the operation, or morphine plus scopolamine or diazepam was given before, during, or after surgery. Five of the patients were over the age of 75 years. Two of the patients received morphine epidurally shortly before being placed in trendelenburg position, possibly facilitating the spread of morphine to the respiratory center of the brainstem. Naloxone was used effectively in the treatment of 8 of the 10 patients without breakthrough pain (Stenseth et al., 1985).

The occurrence of pruritis was not significant. The frequency of urinary retention was no different between the various types of surgeries (Stenseth et al., 1985).

Overall, 91% of the total population were completely satisfied with postoperative course. The highest satisfaction was 97% in patients post hip arthroplasty and lowest in patients post cholecystectomy at 88%. Patients who underwent a thoracotomy had a 91% satisfaction, but, initially required higher doses. The overall evaluation of nurses revealed a 91% satisfaction with the pain relief

the patients received. Highest and lowest percentages correlated with the patients' ratings (Stenseth et al., 1985).

Ready et al. (1991) researched the safety of the use of epidural morphine outside the ICU, which remains a controversial issue. The study involved the experience of 1,106 postoperative patients. Patients were grouped according to surgical site: chest, abdomen, perineum, or lower extremity. Information was collected by the anesthesia providers involved in the Acute Pain Service (APS). Data collected included: (a) epidural morphine dose and time interval between injections, (b) patient reported incisional pain at rest and during coughing or ambulation, using a 0-10 verbal analog scale (VAS), (c) pruritis and nausea of sufficient intensity to require treatment, (d) respiratory depression assessed by respiratory rate and sedation requiring naloxone, (e) catheter migration, and (f) occurrence of infection. Patients evaluated ranged in age from 12-101 years old. The mean age was 49.6 with standard deviation of plus/minus 18.1 years. The predicted maximum risks of complications were calculated using 99% confidence intervals.

Respiratory depression occurred in .2% of the patients. The cases were treated effectively with naloxone and without further sequelae. Nausea and vomiting was observed in 29% of patients. Pruritis observed in 25% of patients. Urinary retention was not evaluated due to a large portion of the patients having foley catheters (Ready et al., 1991).

Effectiveness of pain relief was evaluated using the upper bounds of the 99% confidence interval. A unique aspect of this study was the evaluation of pain at rest and during activity. On average, the highest dose of morphine per 24 hour period utilized was in thoracotomy patients (12.8mg) and lowest in perineum surgeries (6.9mg). The median

score of pain at rest ranged from 0 (perineum surgery) to 1 in the remaining surgical categories. With activity, the median score of pain in perineum surgery increased to 3, abdominal and lower extreminity to 4, and thoracotomy to 5 (Ready et al., 1991).

Education of nurses caring for patients with epidurals proved paramount in this study. The ability to understand and identify potential complications was demonstrated to be necessary for safe and effective pain management. The study revealed that with education and training of nurses, medical supervision, and appropriate protocols for dosing, monitoring, and treatment of side effects, epidural morphine can be used effectively and safely on surgical wards (Ready et al., 1991).

A study by Salomaki et al. (1996) also addressed the use of epidurals on general wards. A prospective study of 305 patients was conducted, evaluating pain and side effects during fentanyl infusion after major surgery. Major surgery was classified as major abdominal surgery, knee and hip arthroplasty, and peripheral vascular surgery. Mean age was 64 plus/minus a standard deviation of 14. Fifty four percent were female and 46% males.

Patients were monitored by ward nurses every hour for the first 24 hours postoperatively, then every 2 hours thereafter. Evaluation was based on assessing respiratory rate, somnolence, relief from pain, and diuresis. Patients somnolence was based on the following scale of 0-4: 0=answers a question normally; 1=dozing; 2=asleep, responds to verbal command; and 3=asleep, respond to painful stimulation but not to verbal command, 4=does not respond to painful stimulation. Respiratory depression was considered if respiratory rate was less than 10 or if patient was more than mildly somnolent. Nausea and vomiting were recorded if treatment required. Pain was evaluated by utilizing a

numerical rating scale (NRS), where 0 means no pain and 10 being the worst pain. Severe pain was classified as greater than a score of 3. The side effects were presented as proportions with 99% confidence intervals. The upper bounds of the 99% confidence intervals represented the worst case estimation of the true population risks with which the findings were compatible (Salomaki et al., 1996).

Respiratory rate less than 10/minute (min) occurred in 1% of the patients. Respiratory rates less than 10/min plus somnolence occurred in .3% of the patients. The two patients who developed respiratory rates less than 10 recovered after cessation of the infusion. The third patient who developed a respiratory rate less than 10 and somnolence recovered after treatment with naloxone and cessation of infusion for 2 hours. Although the occurrence of respiratory depression has been approximately 1% in the previous studies discussed, it is more significant in this study due to a sample size of one third the size of the previous samples. However, Salomaki et al. (1996) included somnolence as part of the criteria for respiratory depression, providing more credence to the results. Nausea and vomiting requiring treatment was reported in 7.2% of the patients. Pruritus occurred in 33.1%. Urinary retention was treated by catheterization in 68.2%.

The majority of patients (61.7%) reported a NRS less than or equal to 3, 30.5% patients had less than three episodes of severe pain, and 7.8% had more than three episodes or more of severe pain. Due again to a smaller sample size, these results are more significant (Salomaki et al., 1996).

As reported in the study by Ready et al. (1991), Salomaki et al. (1996) reemphasized the importance of training nurses who care for patients receiving epidural pain management. Their role was essential as they served as the primary observer for complications. With

appropriate protocols and careful monitoring, epidural infusions proved to be a feasible method for pain relief on surgical wards.

In a more recent study, Rygnestad et al. (1997) conducted a prospective study of 2000 patients evaluating the safety of a developed protocal utilizing epidural infusion of morphine and bupivicaine on surgical wards. One major disadvantage expressed by the research team in regards to limiting the use of epidural infusions to ICU areas, is patients are deprived of the benefit of epidural analgesia in the late postoperative period when being ambulated.

Patients scheduled for major surgery were included in the study. Major surgical cases were classified as vascular procedures, thoracotomies, gastrointestinal cancer surgery, and knee and hip prosthesis. There was no reference to age or age limits in the data, however, the use of epidurals in patients under 15 years of age was rare. Further demographics included gender, with females comprising 47% of the total population, males 50.4%, and in 2.6% sex was not indicated (Rygnestad et al., 1997).

Respiratory depression was evaluated as a respiratory rate less than 8/min. This reflects a lower rate as compared to the study by Salomaki et al. (1996). Nausea and vomiting was evaluated by the following: 0=no nausea, 1=minor nausea, 2=severe, no vomiting, and 3=vomiting. Pruritis was recorded as present or absent. Urinary retention was recorded as present, absent, or catheter. Pain was assessed as less than or equal to 2 at rest or less than equal to 2-3 with activity on a VAS. Statistically data was analyzed with 95% confidence intervals if the observations were normally distributed. Otherwise, the median values and interquartile range were reported. Kruskal-Wallis test was used to compare groups. Differences with $P<.05$ were considered to be clinically significant (Rygnestad et al., 1997).

The mean respiratory rate was 15.1/min during the first 48 hours postoperatively. Three patients (.15%) had a respiratory rate of 5/min. This was effectively managed by administering naloxone and stopping the epidural infusion. No other patients needed naloxone. Thirty one patients (1.6%) had respiratory rates of 6-7/min, requiring intervention, however, only 16 (.8%) were considered problematic and accompanied by sedation and/or hypotension. Respiratory depression onset was gradual and recognized quickly by the staff (Rygnestad et al., 1997). The occurrences of respiratory depression correlated with the previous studies with sample sizes over 1000 (Ready et al., 1991; Stenseth et al., 1985). Salomaki et al. (1996) revealed a comparable occurrence of respiratory depression, however, the samples were significantly different in size. This suggest, relatively speaking, a significant increase in respiratory depression in this latter study.

Nausea was reported in 35.7% of the patients. 13.9% vomited and 4.6% experienced severe nausea without vomiting. Results were comparable to the findings of Ready et al. (1991) and Stenseth et al. (1985). However, Salomaki et al. (1996) results of 7.6% were significantly different.

Pruritis was a frequent observation seen in this study, but not recorded. Urinary retention was not addressed in this study due to foley catheters being maintained until termination of the epidural infusion. This was implemented because the ward staff observed that 40% of the patients developed urinary retention prior to this study (Rygnestad et al., 1997).

The epidural pain management regime provided adequate pain relief in most patients. The overall median VAS score was .1. The lowest score was after vascular surgery in the lower extreminities and orthopedic surgery. The highest scores were recorded in the thoracic

surgery group (Rygnestad et al., 1997). This is consistent with Ready et al. (1991) and Stenseth et al. (1985). Salomaki et al. (1996) divided data based on the type of surgery but did not analyze the effectiveness of pain control with each surgical category.

The well-established theme, that education of nurses and support staff is critical to efficacious and safe infusion of epidural pain management, was reiterated by Rygnestad et al., (1997). With established protocols and education, pain relief was excellent and side effects minimal.

Mahoney et al. (1990) evaluated the effect of contiuous epidural analgesia in postoperative total knee patients by comparing three alternative methods of postoperative analgesia. There were 156 patients in the study divided into three groups. The first group consisted of 42 patients who were given parenteral meperidine or morphine, the second group had 58 patients who received intermittent epidural injections of morphine, and the final group had 56 patients who received continuous epidural infusions of bupivicaine and duramorph. The intensity of postoperative pain was evaluated by the patients on a scale of 1 (no pain) to 10 (incapacitating). The degree of pain relief obtained from analgesics was rated 1 (no relief) to 10 (100% relief). Side effects and medications were recorded. In addition, the range of active and passive joint motion that could be tolerated by the patient was documented by the physical therapist twice a day. There were 73 males and 83 females with a mean age of 66 years.

Four patients required treatment for respiratory depression and pulmonary edema. One of the patients was in group 2, the remaining 3 were in group 3. This represents a 2%-5% occurrence, which is significantly increased from the previous studies mentioned. Factors which may have attributed to this result include; the advanced age of

the four patients, prior cardiac disease, and the fact that they had also received general anesthesia. None of the patients developed delayed respiratory depression. This finding was consistent with the previous studies. In Stenseth et al. (1985), only 2 of the 10 patients developed respiratory depression after 5 hours. The two cases in Ready et al. (1991) occurred 8.5-19.5 hours after the initail dose. The three reported cases in Salomaki et al. (1996) were delayed. The timing of respiratory depression varied in Rygnestad et al. (1997) study. Twenty six cases were reported within the first 6 hours, 4 cases between 6-8 hours and the remaining 4 cases between 10-22 hours.

In group 1, group 2, and group 3, nausea occurred 15%, 34%, and 50% respectively, and vomiting occurred 10%, 22%, and 35% respectively. Pruritis was comparable in all three groups, 15-18%. Urinary retention was not evaluated due to all patients having a foley catheter in place (Mahoney et al., 1990).

Patients in groups 2 and 3 reported greater pain relief than those receiving parenteral analgesics. However, patients in group 2 reported frequent episodes of pain between doses. Patients in group 2 received an average total of 31mg of morphine within 72 hours, which was significantly less than 51mg infused in group 3. Patients of group 1 required almost twice the total dose as group 3 over the same 72 hour period. The epidural patients required 28% less oral narcotics during the remainder of their hospitalization (Mahoney et al., 1990).

Initial range of motion (ROM) was similar for each treatment group. However, there was a significant difference in the ROM at 72 hours between group 1 (12-58 degrees) and group 3 (10-82 degrees). Group 3 also had increased mobility compared to group 1 (Mahoney et al. (1990).

The improvement in rate of rehabilitation addresses length of stay (LOS) and cost issues. Patients LOS didn't differ significantly within group 1 and group 2, 11.2 and 10.8 days respectively. However, group 3 patients were hospitalized for only 9.6 days (P<.01). The savings incurred from this decrease in hospital stay of 2 days was $570, based on the cost of a semiprivate room and two visits per day from the physical therapy department (Mahoney et al., 1990).

In a study by Grass, Zuckerman, Tsao, Sakima, and Harris, (1989), LOS stay was also addressed. A retrospective chart audit was performed comparing LOS between two groups of women post cesarean section (C/S). Group 1 (121 women) received intramuscular injections post surgery and group 2 (222) received patient-controlled analgesia and epidural narcotics (PCEA). LOS was defined as the number of hospital days beginning on the day of the C/S until the day of discharge. Unpaired t-test and chi-squared were used for statistical analysis.

The average LOS of group 1 was 5.00 plus/minus 2.57 days versus 4.26 plus/minus 1.23 days for group 2 (P<.01). Overall, 41% of group 1 were hospitalized 5 or more days compared to 29% for group 2 (P<.05). In group 2,23% were hospitalized less than or equal to 3 days compared to only 11% in group 1 (P<.05). No significant side effects were noted (Grass et al., 1989).

In another study, Slover, Palmer, Hodges, and Tinnell (1989) also performed a retrospective chart audit evaluating LOS in women post C/S. The mean LOS for all patients receiving intramuscular analgesia was 4.67 days plus/minus 2.29, compared to 4.08 plus/minus .88 days for patients on patient controlled analgesia (PCA) or continuous lumbar epidural opioid infusions (CLEA) (P<.05). Postoperative complications were 31% in the intramuscular group and 24% in the PCA or CLEA group.

The studies reviewed indicate the effectiveness of epidural analgesia based on a variety of variables. These include frequency and severity of side effects, type of surgery, degree of pain relief, increased activity and rehabilitation, cost analysis, and length of stay. However, the data does not go a step farther to discern which, if any, surgical cases experience greater pain relief from co-axial narcotics while exhibiting fewer side effects. To continue to improve pain management practices, this additional analysis of the data is necessary.

CHAPTER III: METHODOLOGY

Research Design

In this study data was collected for a descriptive analysis of the co-axial pain service in one military facility. Data was collected through a retrospective chart review utilizing pharmacy records and an analgesia flowsheet. Pharmacy records provided information regarding the type and specificity of the mixture of analgesia solutions used. Types of analgesics generally utilized were duramorph with or without bupivicaine (local anesthetic). The analgesia flowsheet (Appendix A) is a form utilized by the ward staff to record the type of pain medication, route, mode of infusion (continuous or intermittent), adverse reactions, treatments, and outcomes of pain management utilizing co-axial narcotics.

Study Subjects

The study subjects were obtained from a 155 bed hospital with an established pain management service. Patients included were all surgical patients who received co-axial narcotics for pain management from January 1, 1998 to December 31, 1998. The time period included a minimum of 100 subjects in order to more adequately describe patterns of utilization. A total of 100 subjects was sufficient to provide meaningful descriptive data.

Instrumentation

Data was recorded utilizing a tool developed for this study (Appendix C). Variables of interest included: age, gender, type of surgery, type of infusion, and route, as well as measurements of pain, respiratory depression, nausea and vomiting, pruritis, and urinary retention. Treatment was annotated when applicable. Data was encoded as follows at the time of collection to facilitate computer data entry.

Coding:

Gender

1. Female
2. Male

Type of surgery:

1. Orthopedic
2. Thoracotomy
3. Abdominal

If orthopedic, type:

1. Hip
2. Knee
3. Other

Type of infusion:

1. Duramorph
2. Duramorph and bupivicaine
3. Other-write in

Route:

1. Epidural
2. Intrathecal

Pain:

1. Present-4 or greater on VAS
2. Absent-less than 4 on VAS

Respiratory depression:

1. Present
2. Absent

Pruritis:

1. Present
2. Absent

Nausea and vomiting:

1. Present
2. Absent

Urinary Retention:

1. Present
2. Absent
3. Foley

Treatment:

1. None
2. Write in treatment

Data Analysis

All relevant data was cross tabulated by type of surgery and type of infusion utilized with other variables of interest, such as pain and nausea to determine if any relationships exist. Statistical analysis of the data was performed using the Statistical Package for the Social Sciences (SPSS).

CHAPTER IV: PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

Introduction

The purpose of this study was to examine one institutions co-axial pain management service. A retrospective chart audit was used to identify those cases in which patients benefit most from this treatment. In this chapter, a description of the data and report of relationships among variables of interests is presented.

Characteristics of Study Sample

One hundred and thirty three charts were reviewed. Fifty seven (43.3%) were for female patients and 76 (56.7%) were males. Patient ages averaged 58 and ranged from 14 to 75. Charts from three surgical categories: abdominal, thoracotomy, orthopedic were examined for evidence of the adequacy of pain control and frequency of side effects. Data about the type and amount of drugs infused through epidural catheters were also collected.

Abdominal cases included hysterectomies, colon surgeries, and abdominal aortic aneurysm repair. Thoracotomies included all chest surgeries, such as lobectomies and wedge resections. Orthopedic cases were total hips and total knees. Eighty percent (106) of the charts reviewed were from patients who had abdominal surgeries, 22 (16.4%) of these were thoracotomies, and 5 (3.7%) were orthopedic cases.

Three types of drugs were infused through the epidural catheter. The most common was duramorph, which was used in 112 (83.6%) of the cases. Duramorph with bupivicaine was used in two cases (1.5%) and fentanyl with bupivicaine was used in 18 cases (13.4%). In one chart the route of administration was not documented.

Pain

Breakthrough pain was reported in 76 (58.9%) of the cases. Fifty seven (75%) were patients who had abdominal surgery, 17 (22.4%) were thoracotomies, and 2 (2.6%) were orthopedic cases (see Table 1). By surgical category, breakthrough pain occurred in 57 (54.8%) patients who had abdominal surgery, 17 (81%) of thoracotomies, and 2 (50%) of orthopedic cases (see Figure 2).

Table 1.

Occurrence of Breakthrough Pain, by Type of Surgery

Type of Surgery	Total Number	Number with Pain	Percent with Pain
Total Cases	**133**	**76**	**57**
Abdominal	106	57	54
Thoracotomy	22	17	77
Orthopedics	5	2	40

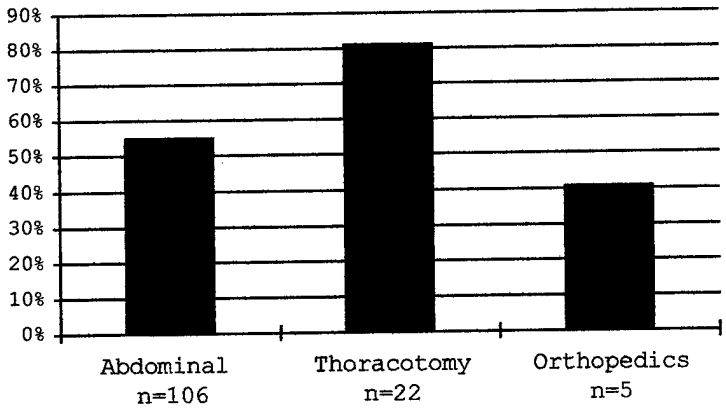

Figure 2. Percent of Breakthrough Pain by Type of Surgery.

Treatment of pain

The treatment of breakthrough pain was managed by either surgeons or anesthesia providers. Treatment included increasing the rate of the epidural infusions and/or bolus dosing of fentanyl through the epidural catheters by physicians or anesthesia providers. In 33 cases epidurals were discontinued within 24 hours. In some of these cases, intravenous patient controlled analgesia was started.

Side effects

Of the 133 charts reviewed there were six reported cases (4.7%) of respiratory depression, and duramorph was used in the epidural infusion in all of these. All six had abdominal surgery. Respiratory depression could not be assessed in 8 (6.3%) patients who had abdominal surgery because they received positive pressure ventilation initially after surgery.

Treatment of respiratory depression

Protocols for treatment of side effects from epidural infusions guided health care providers in caring for patients. Respiratory depression was treated as follows. In one case no change in regimen was documented, but close monitoring reportedly continued. In three cases the epidural infusion was discontinued, however, in one of these it was restarted. Patient controlled analgesia (PCA) was initiated in one case, and narcan was utilized in three cases. In one patient significant depression occurred resulting in a code blue being called. The patient was a 62 year old female who had abdominal surgery. Cardiopulmonary resuscitation occurred for two minutes. The patient responded to two intravenous doses of narcan and a jaw thrust manuever. Prior to respiratory depression, it was documented that pain was absent. In another case, an 89 year old male who had undergone abdominal surgery required intubation and one dose of narcan

intravenously. Interestingly, the epidural narcotic infusion was restarted the next day. Pain relief was not recorded on the patient's flow sheet but "tolerating activity and resting" was documented in the progress notes.

Nausea and vomiting

Forty five of 133 cases (34.9%) nausea and vomiting occurred. Nausea and vomiting occurred more frequently in the group that received duramorph only. Thirty four of 109 patients (26.4%) percent received duramorph only. Patient nausea and vomiting was reported in all three categories. Thirty five percent of 106 of patients who had abdominal surgery reportedly suffered from nausea and vomiting. Seven of the 22 (31.8%) patients who had thoracotomies and 2 of 5 patients who had orthopedic surgeries reportedly had nausea and vomiting (see Figure 3). Abdominal surgery accounted for 80% of patients with reported nausea and vomiting, while 16% of patients who had thoracotomies and 5% of those who had orthopedic surgery had reports of nausea and vomiting.

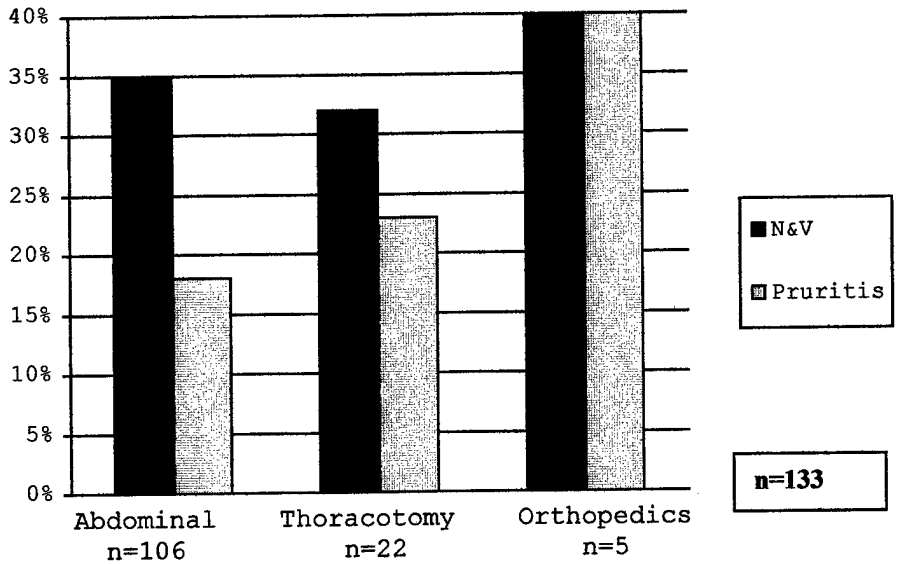

Figure 3. Percent of Patients Reporting Nausea and Vomiting and Pruritis by Type of Surgery.

Treatment of nausea and vomiting. Nausea and vomiting was most frequently treated with the administration of antiemetics. The most common one was droperidol 0.625 milligrams intravenous, used 38 times with 84% reported resolution of nausea and vomiting. Phenergan was used 6 times with 50% reported relief and zofran was used two times with no documentation of effect. In two cases nausea and vomiting resolved without intervention. Overall, droperidol was used most frequently and appeared to provide more frequent relief from nausea and vomiting.

Pruritis

Pruritis was documented in 25 of 133 (19.4%) cases. Twenty one of 109 (16.4%) of patients who had duramorph experienced episodes of pruritis. Pruritis was reported in 18 (17.6%) abdominal cases, five (22.7%) thoracotomy cases, and two (40%) orthopedic cases.

Treatment of pruritis. It was recorded that pruritis was most commonly treated with benadryl and narcan. Benadryl was used 23 times with relief reported in 17 (73.9%) patients. Narcan was used 3 times with one patient reporting relief. No treatment was documented in one case. Greater relief was reported with the use of benadryl.

Urinary retention

It was not possible to determine the incidence of urinary retention as all, with the exception of one patient, had foley catheters. For the one patient who did not have a foley, there was no indication of urinary retention.

Discontinued epidural catheters

Epidural catheters discontinued within 24 hours occurred in 33 (24.6%) cases. Reasons for discontinuation included dislodgement of catheter, inadequate pain control, and physicians orders.

Documentation

While reviewing charts for data collection, incomplete documentation was noted. According to Medical group (MDG) instruction 44-52, form 406 was to be completed on each patient every four hours. Almost 60% of the time this was not accomplished. Although data for this study were collected using this form, it was also necessary to review progress notes and medication sheets to get a complete and accurate data base.

Inconsistencies between progress notes and the form 406 were also noted. For example, in one chart a patient reported a four (on a scale of 10) pain score, which is an indication of inadequate pain control, yet "adequate pain control" was documented in the progress notes.

CHAPTER V: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

A retrospective chart audit of one hundred and thirty three charts was conducted to determine those surgical cases in which patients report the least amount of pain with the fewest side effects after having co-axial narcotics. Charts of patients who had abdominal, thoracotomy, and orthopedic surgery were reviewed and compared.

Discussion

In this study patient data from three surgical categories were compared. Due to the small sample of five patients in the orthopedic group, no conclusions or recommendations are made.

Adequate pain relief was reported most frequently in patients who had abdominal surgery (45.2%), whereas 20% of patients who had thoracotomies reported adequate pain relief. Successful treatment of breakthrough pain included increasing the rate of infusion and bolus dosing by physicians or anesthesia providers. Based on this, one may infer that the initial rate of infusion may not have been adequate. However, inconsistencies in treatment could have occurred because both physicians and anesthesia providers were involved in treating breakthrough pain. Different providers tend to have their own protocol for treating pain.

Though most of the complications observed in this study were minor, six (4.7%) patients were reported to have respiratory depression. Five cases required treatment. This high incidence was comparable to the study by Mahoney et al. (1990), which reported a 2-5% occurrence depending on which of the three groups was assessed. Mahoney et al. evaluated the effectiveness of epidural analgesia by comparing three methods of pain control. The first group was given parenteral meperidine, the second group received intermittent epidural

injections of morphine, and the third group received a continuous epidural infusion of bupivicaine and duramorph. Respiratory depression was reported in four patients who had received epidural analgesia. One patient was in group 2 and the other three patients were in group 3.

The occurrence of nausea and vomiting was comparable for patients who had abdominal and thoracotomy surgery (35% and 31.4% respectively). Since nausea and vomiting could also be a side effect of general anesthesia, data collected in the first 48 hours could be due to this rather than the epidural infusion. In addition, the type of surgery can affect the likelihood of nausea and vomiting occurring. Surgical cases involving the abdomen tend to have a higher incidence of nausea and vomiting postoperatively (Moniz, 1997). This was also found in our study: 80% of the reported cases of nausea and vomiting occurred in patients who had abdominal surgery.

Pruritis was reported more frequently by patients who had thoracotomies (22.7%) than those who had abdominal surgery (17.6%). Overall, 19.4% patients reported pruritis, comparable to previous studies which reported pruritis in 11-33% of the patients (Ready et al., 1991; Salomaki et al., 1996; Stenseth et al., 1985).

Duramorph was the infusion most commonly used. It was used in 83.6% of all cases. Thus it is not surprising that side effects were reported more often in patients who received duramorph.

Recommendations

Nurses in all units need to be further educated about the importance of documentation on 60 Medical Group form 406, as patient assessments are not being documented every four hours. Compliance with guidelines will help ensure that assessments are completed as required and may help in avoiding significant side effects. It would also be beneficial to breakdown each broad surgical category into specific

surgeries. For example, separate abdominal surgeries into hysterectomies, colon surgeries, and vascular surgeries to compare pain relief and side effects. Certain surgeries, such as gynecological or laparoscopic surgeries, are more prone to side effects such as nausea and vomiting (Moniz, 1997). Also, some surgeries are more invasive, increasing probability of pain. Studies comparing different drug infusions to determine those that provide better relief, if any, for specific surgeries is also recommended.

Given the number of discrepencies and breaks in protocol, a pain management service, including a team of providers experienced in pain management might improve outcomes. They could order and adjust epidural doses, providing a more consistent management of patients receiving epidural infusions. The present system does not designate a specific team to write orders. Anesthesia providers initially start the infusion, then the surgeons on those clinical services are responsible for managing the infusions. However, anesthesia providers are often requested to re-evaluate and order any necessary adjustments in the dosage.

Post operative pain management remains one of the most difficult areas in clinical practice. Even with medical advances, surgical patients continue to report complaints of pain. Frequently, health care providers are blamed for not providing adequate pain control of patients.

The use of co-axial narcotics is one of the most recent advances in pain management. Its initial application was in the treatment of cancer pain, which led to its perioperative use. Co-axial narcotics can provide excellent pain relief while using lower doses than other analgesic routes. However, its use outside of ICUs has been limited due to potential adverse effects, such as respiratory depression,

nausea and vomiting, pruritis, and urinary retention. However, these adverse effects are not limited to co-axial narcotics. Regardless of route of administration, opioids can lead to these adverse side effects. Having the necessary expertise and education to manage co-axial narcotics allows safe and effective pain control to be achieved.

Henderson (1966) described the role of nursing in managing patients postoperatively, which depends on patients' needs. On the day of surgery, nursing encompasses approximately one third of the necessary involvement in patients' care. This increases to fifty percent the first postoperative day, and is still present at two weeks. As part of the nursing team, anesthetists are in a position, based on expertise and education, to be lead agents in ensuring safe and effective postoperative pain management.

Further investigations in postoperative management of pain may help determine which regimens work best for patients. This analysis may provide a foundation for health care providers who manage postoperative pain and who will conduct future research.

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APPENDICES

Appendix A: Analgesia Flow Sheet

Appendix B: Medical Group Instruction 44-52

Appendix C: Data Collection Tool

APPENDIX A

Analgesia Flow Sheet

ANALGESIA FLOWSHEET

(This Form is subject to the Privacy Act of 1974 - Use Blanket PAS - DD Form 2005)

ROUTE:
- ☐ PCA (IV)
- ☐ EPIDURAL
- ☐ INTRATHECAL
- ☐ EXTRAPLEURAL
- ☐ INTRAPLEURAL
- ☐ PCA EPIDURAL
- ☐ _____

PAIN SCALE
- ☐ 0 - 10
- ☐ WONG-BAKER FACES
- ☐ BEHAVIORAL PAIN RATING

See Reverse for Scales

LEVEL OF SEDATION (LOS) CODE
1 - AWAKE/ALERT
2 - DROWSY, EASY TO AROUSE
3 - SLEEPING, EASY TO AROUSE
4 - STUPOR, DIFF. TO AROUSE
5 - COMA

MOTOR FUNCTION
LOCAL ANESTHETICS ONLY
+ NORMAL STRENGTH
- SIGNF DECREASED STRENGTH

NV - NAUSEA, VOMITING
UR - URINARY RETENTION
U - URTICARIA
+ PRESENT
- ABSENT

PATIENT'S IDENTIFICATION *(For Mechanical Imprint)*

DATE	TIME	PCA MODE		CONTINUOUS MODE (BASAL)	MAXIMUM LOCKOUT INTERVAL		LOADING DOSE OR BOLUS	PCA		CUMULATIVE DOSE q8 hr	MOTOR FUNCTION	ASSESSMENT						PHYS. ORDER/COMMENTS (Underline Drug) ex. CHANGES, WASTE, CLEARED PUMP HISTORY q8 hr	INIT
		DOSE (mg)	LOCK (min)	mg/hr	hrs	mgs	mg	# DEM	# INJ	mg	UPPER / LOWER (+/-)	PAIN SCORE	RESP RATE	O2 SAT	LOS	NV (+/-)	UR/U (+/-)		

60 M[illegible] Form 406, AUG 95

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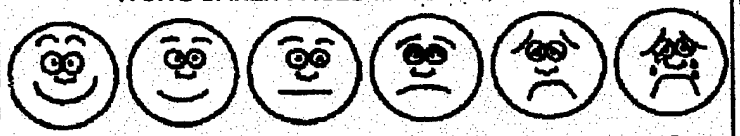
MDGI 44-52 Attachment 6 29 Oct 97

PAIN SCALE 0 - 10 0 = NO PAIN 10 = WORST POSSIBLE PAIN

WONG-BAKER FACES PAIN RATING SCALE



0 1 2 3 4 5

Explain to the person that each face is for a person who feels happy because he has no pain (hurt) or sad because he has some or a lot of pain. Face 0 is very happy because he doesn't hurt at all. Face 1 hurts just a little bit. Face 2 hurts a little more. Face 3 hurts even more. Face 4 hurts a whole lot. Face 5 hurts as much as you can imagine, although you don't have to be crying to feel this bad. Ask the person to choose the face that best describe how he is feeling. Recommended for person age 3 years and older.

BEHAVIORAL PAIN RATING SCALE

Compare your observation of the child to the behaviors on the scale. Rate the child's pain based on the category which most closely resembles the behaviors observed in the child.

PAIN RATING	DEFINITION	CHARACTERISTIC
0	no apparent pain	-resting, not crying, calm -relaxed body posture -denies pain
1	uncomfortable	-intermittent crying -agitated when disturbed -settles self -responds to TLC -easily distractable/consolable -states "uncomfortable"
2	mild pain	-weak, whimpering cry -restless, irritable -difficult to distract -c/o some pain
3	moderate pain	-crying, whiny -irritable, agitated -unable to distract or console -grimacing -holding pain site -c/o moderate pain
4	severe pain	-strong, loud cry, sobbing -tense, drawn up -BP > 20% of resting normal -c/o severe pain
5	extreme pain	-hysterical, out of control -thrashing, kicking, can barely hold still -c/o extreme pain

POLICY REMINDERS

REFER TO MGI XX-XXX

-Precautions 24° after removal of catheter / last dose

-Pulse Oximeter Requirements
- -pre-existing cardiopulmonary disease
- -older than 70 years
- -intrathecal narcotics
- -peds require cardiopulmonary monitoring

MONITORING REQUIREMENTS

A. EPIDURAL/INTRATHECAL

CIRCUMSTANCE	MONITORING FREQUENCY
1. All bolus injections 2. Change of medications 3. Start of continuous infusion 4. Change in infusion rate	INITIAL respiratory rate, BP, P, level of sedation, pain assessment and O2 Sat.°, THEN respiratory rate and level of sedation: Q 15 min. x 4 then Q 1 hours x 2 then Q 4 hours (see below) ° = if indicated
1. Infusion bag changes	Q 4 hours assess the following: Respiratory rate, BP, P, T, level of sedation, pain assessment, O2 Sat.°, possible side effects/complications, urinary retention. ° = if indicated

B. LOCAL ANESTHETIC DRUG PRECAUTIONS:

1) In addition to the monitoring requirements listed above, patients receiving local anesthetics (e.g., Bupivacaine) will have their motor function assessed and documented on the analgesia flow sheet every 4 hours.

2) Watch for postural changes in vital signs and advise the patient to change position slowly. Check postural BP and pulse prior to first ambulation.

C. EXTRAPLEURAL/INTRAPLEURAL

-BP Q1° x 4, then Q4°
-TPR Q4°
-DOSE INCREASE : BP Q1° x 4, then Q4°

Initials	signatures	Initials	signatures

APPENDIX B

Medical Group Operating Instruction 44-52

BY ORDER OF THE COMMANDER
60th Medical Group (AMC)
Travis Air Force Base, California
94535-1800

MDG INSTRUCTION 44-52

29 October 1997

Medical

EPIDURAL AND EXTRAPLEURAL ANALGESIA

(COMPLIANCE WITH THIS INSTRUCTION IS MANDATORY)
"As of 29 October each year, this instruction will be reviewed by the proponent and certified that it is no less restrictive than any related higher headquarters instruction."

This instruction implements AFPD 44-1, Medical Operations. It also establishes guidelines for the safe, standardized care of patients receiving analgesic medications via epidural, intrathecal, and extrapleural routes.

1. Scope: All personnel involved in the care of a patient receiving epidural, intrathecal, or extrapleural analgesia. Exceptions- a) Labor and Delivery personnel, and b) the use of lipid soluble opioids intrathecally in doses up to 25 mcg of Fentanyl or 20 mcg of Sufentanil or epidural doses of up to 250 mcg of Fentanyl or 25 mcg of Sufentanil will not require the initiation of this protocol if it has been more than two hours since either of these medications has been given.

2. Responsibility: All personnel involved in the care of a patient receiving epidural or extrapleural analgesia will be familiar with and adhere to these guidelines. EXCEPTION: Labor and Delivery patients will be cared for IAW applicable unit guidelines.

3. Epidural Analgesia:
3.1.General information: Continuous or intermittent epidural local anesthetic infusions or narcotic injections are an alternate method for providing analgesia. Epidural catheters are placed by anesthesia personnel into the epidural space between the dura mater and the vertebral canal. *Generally, epidural narcotics (e.g., Morphine) will be administered to adults, and epidural anesthetics (e.g., Bupivacaine) will be administered to pediatric patients (generally defined as age 13 or less), as ordered.* Patients who receive an intraoperative bolus of intrathecal morphine will be cared for IAW the policy below for epidural analgesia. **Medications used for epidural administration must be preservative free. Preservatives may be neurotoxic and cause severe spinal cord damage. Strict aseptic technique will be utilized in the care of epidural catheters.**
3.2. Patient Placement: Patients with epidural analgesia will be assigned to a nursing unit in which the nurses have been skill verified in the care of these patients. Placement in an ICU versus a ward will be based upon the patient's medical and nursing needs, not based upon epidural analgesia. However, patients who require parenteral narcotics **concurrently** with the administration of epidural narcotics must be in an ICU (Exception: Young, healthy obstetric patients may receive concurrent narcotics IAW Perinatal unit guidelines). For the administration of parenteral narcotics during the first 24 hours after the last exposure to epidural/intrathecal narcotics, please refer to the section on physician responsibilities.

3.3. Admixture of Epidural Drug Infusions: During the hours that a Pharmacist is available, Pharmacy Service will mix medications for continuous epidural administration. Epidural medications will be mixed in preservative-free saline in the concentration listed on the pre-printed Doctors' Orders for adults and children (Attachments 2 and 3, respectively). Nursing service personnel will not mix these medications. It is therefore important for nursing personnel to ensure orders are received by pharmacy in a timely manner.
3.4. Physician/CRNA Responsibilities
3.4.1. Epidural catheters will only be inserted by a physician or CRNA credentialled in the procedure. A provider who is credentialled or inserviced may discontinue the catheter.

OPR: SGCSA
(Lt Col W. John Hill)

Certified By: 60 MDG/SGA

Printed Pages:

18/Distribution: L;X

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MDGI 44-
52, 29 Oct 97

3.4.2. Anesthesia Service will initiate any continuous epidural infusions. If the epidural dressing becomes soiled, Anesthesia will change the dressing, when requested by the nursing staff.
3.4.3. Anesthesia Service will assist with the education and skill verification of Registered Nurses who are responsible for providing care for patients receiving epidural medications, utilizing the checklist at Attachment 4.
3.4.4. Once epidural or intrathecal narcotics are given, all previous sedative and narcotic orders are automatically cancelled. For patients who have received epidural narcotics within 24 hours, sedatives or narcotics not included in the pre-printed physician orders may only be ordered on a one time basis after clinical evaluation of the pt. by the team physician or Anesthesia Services.
3.4.5. Write physician's orders, utilizing the pre-printed orders for adults or children (Attachments. 2 and 3, respectively), for the care of the patient during the time that the catheter is in place, and for 24 hours following its removal if narcotics were given, or 8 hours if only an anesthetic was given, to include the following:
3.4.5.1. Drug(s), doses, infusion rate, and concentration to be given via epidural catheter, and an anticipated stop date
3.4.5.2. Pulse oximetry monitoring for patients who meet any of the following criteria: a) have pre-existing cardiopulmonary disease, b) over 70 years old, or c) received intrathecal narcotics. Cardiopulmonary monitoring is required for all pediatric patients.
3.4.5.3. Intake and output monitoring at least Q 8 hours
3.4.5.4. Maintenance of IV access (Exception: Physicians may order the discontinuation of IV access for obstetric patients only, provided that it has been more than 8 hours since they were dosed with epidural narcotics, and no further doses will be given.)
3.4.6. A note including the assessment of the epidural insertion site should be documented daily.
3.4.7. In addition to the original physician's orders, an AF 781 (prescription) must be filled out daily (utilized in place of an AF 579) for the Pharmacy to issue a narcotic infusion after the initial bag.
3.4.8. A physician will evaluate the patient and write orders for any necessary adjustments in the dosage of a continuous infusion or bolus doses. **Rescue dosing guidelines are at Attachment 5.** The physician on

the clinical service is also responsible for administering any boluses of epidural narcotics, and **for remaining with patients_outside of an intensive care unit for a minimum of 15 minutes** to monitor for possible adverse effects. **If the provider will not be available to dose the patient in a timely manner, he or she will provide orders for an alternative method of pain relief.**

3.4.9. During hours that a Pharmacist is not available to prepare a continuous infusion, the physician is responsible for ordering bolus dosing of epidural narcotics or another route of analgesia.

3.4.10. If epidural analgesia is not deemed to be effective, the catheter should be discontinued and an alternative route of pain relief employed.

3.4.11. After the last exposure to intrathecal or epidural narcotics, parenteral narcotics within the subsequent 24 hours for adults are limited to a maximum of 5 mg of Morphine Sulfate IV titrated to pain relief, followed by PCA Morphine **without** a basal (continuous) dose. Equianalgesic dosing of another analgesic may be used.

3.4.12. Epidural catheters will remain in place for no longer than 96 hours. The physician will write an order to discontinue the catheter. In addition, a progress note stating that the catheter was removed, the condition of the catheter (e.g., intact), and the appearance of the insertion site will be documented. **(Exception: Anesthesia may order an extension past 96 hours for permanent, tunneled catheters only, and will be responsible for changing the dressing,if any, at that time.)**

3.5. Nursing Responsibilities for Patients Receiving Epidural Analgesia:

3.5.1. An RN may provide care for a patient receiving epidural analgesia providing the following criteria are met:

3.5.1.1. The RN must have written documentation of skill competency verification in the care of pt. receiving epidural analgesia.

3.5.1.2. The RN assuming care of the patient does not do so until the provider who placed the catheter/infusion device has verified correct catheter placement, the patient's vital signs have stabilized and the analgesic level has been established and stabilized.

3.5.2. **The following requirements apply to the entire time that the catheter is in place, and for 24 hours following its removal if narcotics were used, or for 8 hours if only an anesthetic was used** (unless otherwise specified).

3.5.2.1. Place a sign at the head of the bed, "EPIDURAL PRECAUTIONS".

3.5.2.2. List appropriate emergency Naloxone (i.e., Narcan 0.2 mg IV for adult) dose on epidural precautions sign if the pt. is receiving narcotics (see Emergency Measures below). Ensure that Naloxone is readily available on the nursing unit.

3.5.2.3. ALWAYS USE AN EPIDURAL PUMP. If this pump is not available, the physician will be notified and bolus dosing of narcotics or an alternative route of analgesia will be ordered. For this reason it is important that the nursing staff ensure that pumps are returned promptly to the Post Anesthesia Care Unit (PACU) upon discontinuation of continuous epidural infusions.

3.5.2.4. Label the infusion pump, solution bag, line, and catheter "Epidural Infusion". Whenever possible, place the epidural pump used on a separate IV pole from pumps used for intravenous infusions.

3.5.2.5. Ensure oxygen flow meter with ambu bag, appropriate size mask, and suction unit with Yankauer tip are ready for use at the patient's bedside.
3.5.2.6. Maintain an intravenous (IV) access line (patient heparin/saline lock is acceptable.) Exception: Physicians may order the discontinuation of IV access for obstetric patients only, provided that it has been more than 8 hours since they were dosed with epidural narcotics, and no further doses will be given.
3.5.2.7. Place the pt. on fall precautions and assist the patient with any ambulation/activity ordered.
3.5.2.8. Note pre-printed physician orders. All previous sedatives and narcotics are automatically cancelled. For patients who have received epidural narcotics within 24 hours, sedatives or narcotics not included in the pre-printed physician orders may only be ordered on a one time basis after clinical evaluation of the pt. by the team physician or Anesthesia Services.
3.5.2.9. Respiration rates will be determined before stimulating the pt. (e.g., waking pt. up; taking BP, temp., pulse).
3.5.2.10. Monitor intake and output, as ordered, minimum of Q 8 H
3.5.2.11. Instruct patients who are able to move themselves to arch their lower back before moving to prevent accidental dislodgment of the catheter. Patients who are unable to move themselves will be lifted to avoid "shearing" movements.
3.5.2.12. Ensure that the catheter is securely taped along the back and secured up over the shoulder. Maintain sterility of epidural puncture site and infusion system.
3.5.2.13. Two RNs must check the IV bag to verify the correct patient, medication, proper dosage, concentration, and infusion rate for epidural analgesia are correctly programmed into the epidural pump upon accepting care of the patient, at the start of the infusion, when any changes are made to the infusion, and at each change of shift. This information will be documented on the Analgesia Flow Sheet (Attachment. 6).
3.5.2.14. The key pad of the epidural pump will be kept locked to prevent inadvertent changes from being made to the infusion rate. Infusions of narcotics or anesthetics must remain locked within the epidural pump.

3.5.2.15. Monitoring Requirements:

CIRCUMSTANCE	MONITORING FREQUENCY
1. All bolus injections 2. Change of medications 3. Start of continuous infusion 4. Change in infusion rate 5. Administration of parenteral narcotics within 24 hours of patient's last exposure to epidural narcotics (e.g., initial IV bolus before PCA, or with each dose of IM narcotics).	INITIAL respiratory rate, BP, P, level of sedation*, pain assessment* and O2 Sat.**, THEN respiratory rate and level of sedation*: Q 15 min. X 4 then Q 2 hours X 2 then Q 4 hours (see below) *=See scales on Analgesia Flow Sheet **=If indicated
General Monitoring Requirements	Q 4 hours assess the following: Respiratory rate, BP, P, T, level of sedation*, pain assessment*, O2 Sat.**, possible side effects/ complications of epidural analgesia, and urinary retention. *=See scales on Analgesia Flow Sheet **=If indicated

3.5.2.16. **Anesthetic Drug Precautions:** (Next Page)

3.5.2.16.1. **In addition to the monitoring requirements listed above,** patients receiving anesthetics (e.g., Bupivacaine) will have their motor function assessed and documented on the Analgesia Flow Sheet every 4 hours.

3.5.2.16.2. Watch for postural changes in vital signs. Check postural BP and pulse prior to first ambulation. Advise the patient to change positions slowly.

3.5.2.17. Conditions requiring **stat** notification of service provider and **immediate hold of epidural medications: (see emergency measures below)**

3.5.2.17.1. Decline in mental status, or difficulty/inability to arouse pt. **This is the first indicator of impending respiratory distress.** Assume that these changes are due to hypoxia and/or hypercarbia until proven otherwise by arterial blood gases and follow emergency treatment for respiratory depression below.

3.5.2.17.2. Decline in respiratory status (arterial carbon dioxide level [paC02] > 50mmHg, RR $\leq$ 10/minute, apnea greater than 20 seconds, or oxygen saturation [SpO2] $<$ 90%). Respiratory depression related to long-acting Morphine peaks within 6 hours after dosing, but can occur up to 18-24 hours later. Respiratory depression from Fentanyl occurs within the first few hours.

3.5.2.17.2.1. **Emergency measures for adults:** Turn off the epidural infusion, stimulate the pt. to breathe and place O2 on at 8 L/min. by mask. **RN to remain with patient and have another staff member bring crash cart to patient's bedside.** If stimulation does not immediately result in a respiratory rate >10/min. and a SpO2 > 90%, and the patient has received narcotics, administer Naloxone (Narcan) 0.2 mg IV STAT. Be aware that rapid administration of Naloxone can cause hypertension, cardiac dysrhythmia, pulmonary edema, and cardiac arrest. Support respirations via ambu bag with 100% O2 as needed. If these measures are not effective, follow Code Blue procedures.

3.5.2.17.2.2. **Emergency Measures for Pediatric Patients:** Turn off the epidural infusion, stimulate the pt. to breathe and place O2 on at 50% by Venti-mask. RN TO REMAIN WITH PATIENT AND HAVE ANOTHER STAFF MEMBER BRING CRASH CART TO PATIENT'S BEDSIDE. If stimulation does not immediately result in a respiratory rate > 10/min. and a SpO2 > 90%, and the patient has received narcotics, administer Naloxone 0.01 mg/kg. Be aware that rapid administration of Naloxone can cause hypertension, cardiac dysrhythmia, pulmonary edema, and cardiac arrest. Support respirations via ambu bag with 100% O2 as needed. If these measures are not effective, follow Code Blue procedures.

3.5.2.17.3. Hypotension (consider allergic reaction as cause): **Emergency Measures:** Turn off the epidural infusion. RN TO REMAIN WITH PATIENT AND HAVE ANOTHER STAFF MEMBER BRING CRASH CART TO PATIENT'S BEDSIDE. Place O2 on at 8 L/min. by mask for an adult or 50% Venti-mask for a child. Prepare to administer fluids and medications.

3.5.2.17.4. Loss of sensation which is rapidly moving upward, rapid onset of motor blockade, and/or hypotension (consider allergic reaction and local anesthetic toxicity as other possible causes of hypotension): **Emergency Measures:** Turn off the epidural infusion. Place oxygen 8 L/min. by mask for an adult or 50% by venti-mask for a pediatric patient. RN TO REMAIN WITH PATIENT AND HAVE ANOTHER STAFF MEMBER BRING CRASH CART TO PATIENT'S BEDSIDE. If respiratory depression is present, treat as noted above. Prepare to administer fluids and medications.

3.5.2.17.5. Major signs of local anesthetic toxicity: tremors, seizures, coma, respiratory arrest, hypotension, dysrhythmias, cardiac arrest: **Emergency Measures:** Turn off the epidural infusion. RN TO REMAIN WITH PATIENT AND HAVE ANOTHER STAFF MEMBER BRING CRASH CART TO PATIENT'S BEDSIDE. Treat respiratory arrest and hypotension as noted above.

3.5.2.18. Conditions which require timely notification of service resident:

3.5.2.18.1. Loss of catheter sterility (wrap end in sterile 4 X 4)

3.5.2.18.2. Catheter dislodgement (stop infusion; save catheter if it becomes completely dislodged for the service physician to verify that the catheter is intact)

3.5.2.18.3. Drainage from the catheter site (small amount of serous drainage is normal)

3.5.2.18.4. Pain at the catheter site

3.5.2.18.5. Postural vital sign changes

3.5.2.18.6. Inability to void within 6 hours of dosing, or bladder distention (more likely to occur in men)

3.5.2.18.7. Signs and symptoms of local or systemic infection (i.e., fever, nuchal rigidity, increased WBC, catheter site inflammation)

3.5.2.18.8. Inability to maintain IV access

3.5.2.18.9. Intractable pruritis, nausea, vomiting, headache which is not responsive to treatment already ordered (pruritis more likely to occur in women)

3.5.2.18.10. Inadequate analgesia

3.5.2.18.11. Early mainifestations of local anesthetic toxicity: circumoral numbness or tingling, metallic taste, ringing in the ears, vertigo, blurred vision.

3.5.3. Skill Verified RNs may do the following:

3.5.3.1. Adjust the dosage of a continuous epidural infusion, based upon physician orders, after the physician and nurse have thoroughly assessed the patient.

3.5.3.2. Change the IV bags containing medication for continous epidural infusion (to be mixed by Pharmacy only) every 24 hours and PRN. The epidural tubing and dressing do not require routine changing because the catheter must be removed within 96 hours. However, if the dressing becomes soiled, ask Anesthesia to change the dressing. Anesthesia may order an extension past 96 hours for permanent, tunneled catheters only, and will be responsible for changing the dressing (if any) at that time.
3.5.4. Patient instructions:
3.5.4.1. Answer any questions that the patient or family have about epidural analgesia.
3.5.4.2. Instruct the patient/family regarding fall precautions.
3.5.4.3. Instruct the patient/family to notify staff about a decreased level of alertness, slow or difficult breathing, change in level of pain control, symptoms of infection, and any other side effects associated with epidural analgesia.
3.5.5. Assessment and documentation will include at least the following:
3.5.5.1. VS and pt. assessment per protocol above
3.5.5.2. Time infusion started and discontinued
3.5.5.3. Time catheter discontinued and by whom
3.5.5.4. Teaching related to epidural and pt./family response
3.5.5.5. Every 4 hours:
3.5.5.5.1. Pain assessment(including the Behavioral Pain Rating Scale for very young children, Wong-Baker Pain Rating Scale for children with a developmental age of 3 years old or greater, or the 0-10 scale for older children and adults), and response to analgesia. (Attachment. 5)
3.5.5.5.2. Presence/absence of epidural-related side effects/complications
3.5.5.5.3. Epidural-related interventions and pt. Response

3.5.5.6. Every 8 hours: Intake and output (or more frequently as ordered)
3.5.5.7. Every shift:
3.5.5.7.1. Catheter and dressing appearance
3.5.5.7.2. Any analgesic or sedative medications administered and by whom, including shift total for narcotics and/or local anesthetics
3.5.5.8. Appearance of the insertion site will be documented at the time the catheter is removed, and once a shift X 2 after that.
3.5.5.9. Any time that any narcotic from the epidural infusion is wasted (e.g., change bag or discontinue infusion), the following must be documented on the Analgesia Flow Sheet: a) the amount of narcotic infused, b) the amount of narcotic wasted, and c) the initials of two nurses (or a nurse and a physician).

APPENDIX C

Data Collection Tool

Date	ID #	Age/S	TOS	O T	Infusion	Rt	Pain	Tx	R D	Tx	N&V	Tx	Pru	Tx	U R	Tx	Other

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